

1. A method of regenerating a metal pickling process solution containing a metal salt of a first acid, comprising:

a) providing a metal pickling process solution containing a metal salt of a first acid;

5 b) adding a second acid to said solution to produce a regenerated first acid and a metal salt of said second acid;

c) crystallizing said metal salt of said second acid; and

d) removing said metal salt of said second acid from said solution.

10 2. A method as set forth in Claim 1, wherein said first acid is hydrochloric acid and said metal salt of said second acid is ferrous sulfate heptahydrate.

15 3. A method as set forth in Claim 2, wherein said adding a second acid to said solution comprises adding said second acid at a temperature lower than 65 degrees F.

4. A method as set forth in Claim 2, wherein said adding a second acid to said solution comprises adding said second acid at a temperature lower than 40 degrees F.

5. A method as set forth in Claim 2, wherein said adding a second acid to said solution comprises adding said second acid at a temperature in the range of 0 degrees F to 40 degrees F.

6. A method as set forth in Claim 1, wherein said first acid is hydrochloric acid.

7. A method as set forth in Claim 3, wherein said second acid is sulfuric acid.

8. A method as set forth in Claim 1, further comprising the step of decreasing the solubility of said metal salt of said second acid.

9. A method as set forth in Claim 1, wherein said second acid is added in excess of the stoichiometric amount.

10. A method as set forth in Claim 1, further comprising the step of recycling the regenerated first acid to the metal pickling process.

11. Apparatus for regenerating a metal pickling process solution containing a metal salt of a first acid, comprising:

a) means for providing a metal pickling process solution containing a metal salt of a first acid;

b) means for adding a second acid to said solution to produce a regenerated first acid and a metal salt of said second acid;

c) means for crystallizing said metal salt of said second acid; and

d) means for removing said metal salt of said second acid from said solution.

12. Apparatus for regenerating a metal pickling process solution containing a metal salt of a first acid as set forth in Claim 11, further comprising means for recycling the regenerated first acid to the metal pickling process.

13. Apparatus for regenerating a metal pickling process solution containing a metal salt of a first acid as set forth in Claim 11, wherein said first acid is hydrochloric acid and said metal salt of said second acid is ferrous sulfate heptahydrate.

14. Apparatus for regenerating a metal pickling process solution containing a metal salt of a first acid as set forth in Claim 11, wherein said means for adding a second acid to said solution metal comprises adding said second acid at a temperature lower than 65 degrees F.

15. A method of regenerating a ferrous metal pickling process solution containing ferrous chloride, comprising:

a) providing a ferrous metal pickling process solution containing ferrous chloride;

b) adding sulfuric acid to said solution to produce regenerated hydrochloric acid and ferrous sulfate;

c) crystallizing ferrous sulfate heptahydrate; and

d) removing said ferrous sulfate heptahydrate from said solution.

16. A method as set forth in Claim 15, further comprising the step of recycling the regenerated hydrochloric acid to the ferrous metal pickling process.

17. A method as set forth in Claim 15, wherein said sulfuric acid is added to said solution at a temperature between about 25 degrees F and about 35 degrees F.

18. A method as set forth in Claim 15, further comprising the step of decreasing the solubility of said ferrous sulfate.

19. A method as set forth in Claim 18, wherein the step of decreasing said solubility comprises adding sodium sulfate.

20. A method as set forth in Claim 15, wherein said sulfuric acid is added in excess of the stoichiometric amount.

21. A method of pickling a metal, comprising:

- a) contacting said metal with a solution including a first acid for a time sufficient to provide pickling;
- b) removing said metal from said solution;
- c) adding a second acid to said solution to produce a regenerated first acid and a metal salt of said second acid;
- d) crystallizing said metal salt of said second acid; and
- e) removing said metal salt of said second acid from said solution.

